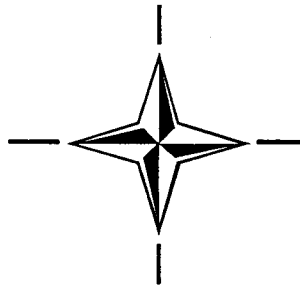


NATO/PfP UNCLASSIFIED

STANAG 4433
(Edition 1)

**NORTH ATLANTIC TREATY ORGANIZATION
(NATO)**



**NATO STANDARDIZATION AGENCY
(NSA)**

**STANDARDIZATION AGREEMENT
(STANAG)**

SUBJECT: FIELD MORTAR MUNITIONS, DESIGN SAFETY REQUIREMENTS

Promulgated on 8 October 2001

A handwritten signature in black ink, appearing to read 'Jan H. Eriksen', is positioned above the printed name and title.

Jan H ERIKSEN
Rear Admiral, NONA
Director, NSA

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RECORD OF AMENDMENTS

No.	Reference/date of amendment	Date entered	Signature

EXPLANATORY NOTESAGREEMENT

1. This NATO Standardization Agreement (STANAG) is promulgated by the Director, NSA under the authority vested in him by the NATO Military Committee.
2. No departure may be made from the agreement without consultation with the tasking authority. Nations may propose changes at any time to the tasking authority where they will be processed in the same manner as the original agreement.
3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

DEFINITIONS

4. Ratification is "In NATO Standardization, the fulfilment by which a member nation formally accepts, with or without reservation, the content of a Standardization Agreement" (AAP-6).
5. Implementation is "In NATO Standardization, the fulfilment by a member nation of its obligations as specified in a Standardization Agreement" (AAP-6).
6. Reservation is "In NATO Standardization, the stated qualification by a member nation that describes the part of a Standardization Agreement that it will not implement or will implement only with limitations" (AAP-6).

RATIFICATION, IMPLEMENTATION AND RESERVATIONS

7. Page (iii) gives the details of ratification and implementation of this agreement. If no details are shown it signifies that the nation has not yet notified the tasking authority of its intentions. Page (iv) (and subsequent) gives details of reservations and proprietary rights that have been stated.

FEEDBACK

8. Any comments concerning this publication should be directed to NATO/NSA - Bvd Leopold III, 1110 Brussels - BE.

RATIFICATION AND IMPLEMENTATION DETAILS
STADE DE RATIFICATION ET DE MISE EN APPLICATION

N A T I O N A L P A Y S	NATIONAL RATIFICATION REFERENCE	NATIONAL IMPLEMENTING DOCUMENT	IMPLEMENTATION/MISE EN APPLICATION					
	REFERENCE DE LA RATIFICATION NATIONALE	DOCUMENT NATIONAL DE MISE EN APPLICATION	INTENDED DATE OF IMPLEMENTATION			DATE IMPLEMENTATION WAS ACHIEVED		
			DATE ENVISAGEE DE MISE EN APPLICATION			DATE EFFECTIVE DE MISE EN APPLICATION		
			NAVY MER	ARMY TERRE	AIR	NAVY MER	ARMY TERRE	AIR
BE								
CA	2441-4433 (DAPM 4-3) of/du 06.10.00	STANAG	12.00	12.00	12.00			
CZ								
DA	FKO MAM3 204.69-S4433 9805425-005 of/du 14.12.99	STANAG	11.01	11.01	11.01			
FR	Décision N°001286 DGA/DSA of/du 20.09.99	STANAG	10.99	10.99	10.99			
GE	BMVg - Fü S IV 1 - Az 03-51- 60 of/du 31.08.99	STANAG	12.01	12.01	12.01			
GR								
HU								
IT								
LU								
NL								
NO	MAS 16/99/FO/LST/OHS/ STANAG 4433 of/du 12.02.99	STANAG	11.01	11.01	11.01			
PL								
PO								
SP								
TU								
UK	D/DStan/12/15/4433 of/du 15.02.00	STANAG		08.01				
US	OUUSD(A&T) of/du 04.12.99	STANAG	12.99	12.99	12.99	12.99	12.99	12.99

NATO STANDARDIZATION AGREEMENT
(STANAG)

FIELD MORTAR MUNITIONS, DESIGN SAFETY REQUIREMENTS

Annexes: None

Related documents:

AAP-6	NATO Glossary of Terms and Definitions
AOP-2	The Identification of Ammunition.
AOP-7	Manual of Tests for the Qualification of Explosive Materials for Military Use.
AOP-16	Fuzing Systems: Safety Design Guides.
AOP-20	Manual of Tests for the Safety Qualification of Fuzing Systems.
AOP-39	Guidance for the Development, Assessment and Testing of Insensitive Munitions (MURAT)
STANAG 2895	Extreme Climatic Conditions and Derived Conditions for Use in Defining Design/Test Criteria for NATO Forces Materiel.
STANAG 2914	Mechanical Environmental Conditions to which Materiel intended for use by NATO Forces could be Exposed – AECP-1
STANAG 2916	Nose Fuze Contours and Matching Projectile Cavities for Artillery and Mortar Projectiles.
STANAG 4110	Definition of Pressure Terms and their Inter-Relationship for Use in the Design and Proof of Cannons and Ammunition.
STANAG 4123	Determination of the classification of military ammunition and explosives.
STANAG 4147	Chemical Compatibility of Ammunition Components with Explosives and Propellants (Non-Nuclear Applications).
STANAG 4157	Development of Safety Test Methods and Procedures for Fuzes for Unguided Tube Launched Projectiles.
STANAG 4170	Principles and Methodology for the Qualification of Explosive Materials for Military Use.
STANAG 4187	Fuzing Systems - Safety Design Requirements.
STANAG 4225	The Safety Evaluation of Mortar Bombs.
STANAG 4238	Munition Design Principles, Electrical/Electromagnetic Environments.
STANAG 4239	Electrostatic discharge, munition test procedures.
STANAG 4297	Guidance on the Assessment of the Safety and Suitability for Service of Munitions for NATO Armed Forces – AOP-15
STANAG 4324	Electromagnetic Radiation (Radio Frequency), Test Information to determine the Safety and Suitability for Service of Electro-explosive Devices and Associated Electronic Systems in Munitions and Weapon Systems.
STANAG 4363	Fuzing Systems: Development testing for the assessment of Lead and Booster Explosive Components.
STANAG 4375	Safety Drop, Munition Test Procedure.
STANAG 4439	Policy for Introduction, Assessment and Testing of Insensitive Munitions.
STANAG 4518	Safe Disposal of Munitions, Design Principles and Requirements, and Safety Assessment.

AIM

1. The aim of this agreement is to provide within NATO design safety requirements for mortar munitions.

AGREEMENT

2. Participating nations agree to design mortar munitions in accordance with the requirements of this STANAG. The agreement is applicable to the development of new mortar munitions, and the modification or conversion of mortar munitions, initiated after ratification. Evidence of compliance with these requirements will be provided by the developing nation to participating nations in response to a valid request.

DEFINITIONS

3. The following terms and definitions are used for the purposes of this agreement:
 - a. Mortar Munition. The term mortar munition means the complete munition, comprising projectile and propellant system. The projectile normally comprises fuze, body filled with HE or other filling, obturator, and tail assembly. The propellant system normally includes a primary cartridge and an augmenting cartridge(s).
 - b. Primary Cartridge. The term primary cartridge includes case, primer and primary charge. The primary cartridge is used to ignite the augmenting cartridge(s). In the case of mortar munitions with no augmenting cartridge, the primary cartridge will itself act as the propelling charge. The primary cartridge can be a single or multiple component item, all the items are located inside the tail tube.
 - c. Primer. The term primer describes the initiating explosive, normally contained within a cap, and a booster. Its function consists of transforming an external action, normally mechanical or electrical, into sufficient energy to ignite the primary charge.
 - d. Augmenting Cartridge. The term augmenting cartridge describes an additional charge that is used to increase the range of the munition. It is composed of the propellant and its container, which can be a combustible case. One or more augmenting cartridges, possibly of different types, can be used for one munition.
 - e. Charge. The propellant contained in a primary and augmenting cartridge.
 - f. Service Life. The Service Life is the time for which the munition, in specified storage conditions and when subsequently used in its operational and/or training condition, may be expected to remain safe and serviceable.
 - g. Storage Life. The Storage Life is the length of time for which an item of supply, including explosives, given specific storage conditions may be expected to remain serviceable and safe, (AAP-6).
 - h. Cook Off. Cook Off is the premature ignition of energetic material due to excessive heat.

GENERAL

4. The objective of the requirements listed in this agreement is to optimize the safety of the mortar munition. The requirements are based on relevant safety experiences, background information, practice and test experiences gained over many years.
5. The design safety requirements in this agreement cover all influences affecting the mortar munition during the Manufacture to Target or Disposal Sequence (MTDS).
6. The mortar munition developer shall be obliged to follow the design safety requirements contained in this STANAG when choosing the material and design for the mortar munition. These requirements shall also apply to the modification or conversion of mortar munitions. The impact of the modification on safety shall be assessed and if it is demonstrated that the modification has no influence on the safety, then no additional tests are required. If there are potential safety implications the requirements of this STANAG shall be applied.
7. After ratification of this STANAG (including related documents) the agreement shall be applicable to all future development of mortar munitions. The STANAG is implemented when a nation confirms that the development and design of mortar munitions will be carried out in compliance with the STANAG requirements. This compliance shall be certified by an appropriate national safety approving authority.
8. Designs which do not meet the requirement of this STANAG, or which operate on new principles, or which represent new applications, shall be presented to the National Safety Approving Authority fully documented for evaluation and possible acceptance on a waiver basis. The reasons for the waiver will be made known to other participating nations who may request information on the design concerned.

DETAILS OF THE AGREEMENT

9. The mortar munition shall be designed so that it is safe to store, handle, transport and to fire. It shall also be safe to dispose of at the end of its Service or Storage Life. Compliance with the design safety criteria listed in this STANAG will be demonstrated by either tests or assessments, or both as appropriate, in accordance with STANAG 4225 and other related documents.

General Requirements

10. The design safety requirements shall prevent or reduce the occurrence or effects of the following hazards:
 - a. Electromagnetic fields, sources of electrical, chemical or mechanical energy, thermal energy, sources of radioactivity, hazardous materials or reaction products.
 - b. Premature initiation of explosive train or premature activation.
 - c. Risks to mortar crews during loading and firing.
11. Guidelines for assessing safety are contained in AOP-15. Applicable portions of that document shall be applied to the design and development of the mortar munition in conjunction with STANAG 4297.

Design Safety Requirements for Mortar Munitions

12. Within the scope of munition development the design safety requirements described in this STANAG shall apply to both the mortar munition components and the assembled munition.

13. Mortar Munition Components. The mortar munition consists of the following components:

- a. Munition Body.
- b. Munition payload (eg: detonating, illuminating, smoke generating, heat (IR) generating), passive or active sub munitions.
- c. Obturator.
- d. Tail Assembly.
- e. Propellant system
- f. Fuze.

14. Munition Body. The munition body shall be designed to meet the following safety requirements:

- a. The material and design of the body shall withstand the physical loads experienced during transport, handling, loading and firing.
- b. The munition body shall be sealed against the propellant gases developed during launch.
- c. The strength of the body must not deteriorate throughout the Service or Storage Life of the munition.

15. Munition Payload. The munition payload shall meet the following design safety requirements:

- a. The physical and chemical characteristics of the munition payload shall be specified. The toxicity of the payload or its decomposition products shall not exceed the levels laid down by National Safety Approving Authority. The existence, type and extent of any toxic hazard shall be stated.
- b. The payload shall be qualified in accordance with AOP-7 in conjunction with STANAG 4170. The explosive components should be chosen to meet the requirements of STANAGs 4439 and 4518.
- c. The payload shall remain safe and serviceable during storage, transport, loading and firing, throughout the munitions Service Life.
- d. The payload shall be compatible with munition components in accordance with STANAG 4147.
- e. During the entire Service Life or Storage Life of the munition the chemical and physical stability of the payload in all specified environments shall not degrade to an unsafe level.

16. Tail Assembly. The tail assembly shall be designed to incorporate the following safety requirements:
- a. The tail and its connection to the munition body shall withstand all launching loads.
 - b. The tail assembly shall not become detached or distorted to the extent that it affects the bomb's flight, even when fired at the extreme service condition.
17. Obturator. The obturator shall meet the following design safety requirements:
- a. It shall provide efficient obturation at all launch pressures.
 - b. It shall permit the munition to slide down the barrel at all specified elevations.
 - c. The obturator must not present a hazard to the crew or nearby troops once the munition has left the barrel.
18. Propellant system. The design of the propellant system charge shall meet the following safety requirements:
- a. During the entire Service Life or Storage Life of the munition the chemical and physical stability of the propellant system charge in all specified environments shall not degrade to an unsafe level.
 - b. All explosive components of the propellant system , including containers if they are made of an energetic material, shall be qualified in accordance with AOP-7 in conjunction with STANAG 4170.
 - c. All propellant system components shall be compatible in accordance with STANAG 4147.
 - d. The propellant system shall function safely without leaving glowing or unburned residue in the barrel. No burning residue which could present either a direct or indirect hazard to the crew or adjacent troops shall exit the barrel.
 - e. The propellant system shall not cook-off if the munition is placed in a hot barrel after the mortar has been firing.
 - f. The propellant system should not produce toxic gases when burning. If toxic gases are produced during burning, then they shall not exceed the levels laid down by National Safety Approving Authority.
 - g. The propellant system shall meet the test requirements laid down in STANAG 4225.
 - h. During extreme (high/low) temperature firings, as defined in STANAG 4225, no extraordinary discontinuities of chamber pressure should occur.
- The munition shall be safe to handle and safe when dropped as specified in STANAGs 4225 and 4375. Inadvertent dropping on the tail shall not initiate the charge.
- j. Muzzle flash and blast over pressure shall not endanger the operating crew.

- k. The electrostatic charging of any part of the propellant system shall be prevented by appropriate measures.
- l. The structural integrity of the augmenting charge container shall be maintained in all specified environments.
- m. The required propellant weight for each augmenting cartridge shall be defined to allow calculation of the full augmenting charge.
- n. The augmenting charge, if designed to be attached, shall be attached to the mortar munition in such a manner that it does not separate inadvertently. Charge selection by the user, if required, shall be easy to perform.
- o. The augmenting cartridge propellant, the primary cartridge propellant, and the primer explosive shall be protected from humidity by their container.
- p. The primer shall initiate the propellant system properly at all specified barrel elevation angles and throughout the required temperature range.
- q. During launch, no component of the propellant system (in particularly the primer) shall come loose and there shall be no damage to the striker by back-flowing gases.

19. Fuze. The fuze, which is considered an independent component, shall comply with the design safety requirements of STANAG 4187 and AOP-16. The fuze shall be tested in accordance with STANAG 4157 and any leads and boosters tested in accordance with STANAG 4363. The following design safety requirements shall be met by all mortar fuzes:

- a. Fuze shape and design shall be such that no explosive reaction will take place when the barrel is inadvertently double loaded. If this requirement is not met then the design shall be presented to The National Safety Approving Authority for possible waiver consideration. Any design waivers will be made known to other participating nations who may request information concerning the design.
- b. The fuze shall be designed so that if damaged (to a certain extent) it can be safely removed from the munition body.
- c. Function-related fuze manipulations, such as time setting and partial arming, shall be simple and reliable under all specified tactical conditions.

20. The Assembled Munition. The following design safety requirements shall apply to the assembled munition:

- a. The different munition types shall be identified with corresponding colour or letter codes or other markings in accordance with AOP-2. The munition shall be designed for reliable and safe handling under adverse weather and lighting conditions. The munition shall be ergonomically designed and possess no sharp edges which could cause injury or damage NBC protective clothing during handling.
- b. Mortar munition design shall provide for exchangeability of components which have a life less than the Service or Storage Life of the munition.

- c. The assembled bomb must be durable and will be tested for this by overpressure firings in accordance with STANAG 4225.
- d. The propelling charge system must be safe and reliable during launch (i.e. ignition, passage through the barrel, muzzle exit). Muzzle flash or after-flame shall be within prescribed limits as laid down in the specification stated by the user.
- e. In case of double loading, the hazard shall be reduced by designing the primary cartridge so that it cannot be initiated by the nose of the fuze of the bomb already in the barrel. Each nation shall be free to perform investigations on the effects of double loading, which should be repeated after every modification of the explosive train.
- f. To allow interchange of mortar munitions between NATO partners all safety related aspects shall be reported to the National Safety Approving Authority. The safe firing of interchangeable mortar ammunition shall be tested and the results documented.
- g. When a munition which contains an Electro-Explosive Devices (EED) is exposed to the specified electromagnetic environment it shall not induce a level of electromagnetic energy into the firing circuit, which would exceed a defined safe margin below the established No-Fire Threshold (NFT) energy level of the EED. NFT will be measured in accordance with national procedures and the EED will be tested in accordance with STANAGs 4239 and 4324.
- h. Each munition shall be designed to withstand all extreme but credible climatic conditions throughout its Service Life, as defined in STANAG 2895.
- i. The munition shall remain safe, stable, accurate and consistent over its operating range.
- j. The blast overpressure in the vicinity of the crew, or locations likely to be occupied by adjacent personnel, is to fall within the limits of national acceptance criteria.
- k. The munition must be designed so that if there is a misfire or if it is not fired, it can be easily and safely removed from the barrel, and disposed of safely.
- l. The munition shall be designed to meet the requirements laid down in STANAGs 2914 and 4225.

IMPLEMENTATION OF THE AGREEMENT

- 21. This STANAG is considered implemented by a nation when that nation has issued instructions that all new mortar munition designs procured for service use will be designed in accordance with the requirements detailed in this agreement.